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Clarkeinda trachodes (*Agaricales*, *Basidiomycetes*), first record from Bangladesh

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Abstract — An interesting agaric, *Clarkeinda trachodes*, is reported for the first time from Bangladesh. A full description, discussion, and illustrations are provided. The enigmatic agaric genus, currently known only from south and southeast Asia, is characterized by the presence of a fawn colored pellicle on the central pileus surface, a stipe with a superior annulus and basal volva, and thick-walled pigmented spores with a slightly depressed truncated apex. Our examination of a voucher specimen from Italy indicates that a recent report of *Clarkeinda* in Europe was based on a misidentified *Agaricus* collection.

Key words — *Agaricaceae*, distribution, morphology, taxonomy

Introduction

Taxonomic reports on macrofungi of Bangladesh are rare in the literature. As a part of an ongoing effort to document the macrofungi of South Asia, we report the presence of *Clarkeinda trachodes* from Bangladesh for the first time. We provide a detailed morphological description, photographs, and line drawings of this enigmatic agaric.

Materials & methods

During November 2009 and June 2010 specimens were collected several times in two different locations in Bangladesh: Bhawal National Park, Gazipur (24°45'N 90°50'E; altitude 20 m), and Akhanagar, Thakurgaon, in northern Bangladesh, (26°03N' 88°47'E; altitude 67 m). Specimens were deposited in the SAU Herbarium of Agarics Flora (SHAF; Plant Pathology Department, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, Bangladesh) and in the Kunming Institute of Botany Herbarium, Academia Sinica (KUN, with HKAS numbers), Kunming, Yunnan, China.

Fresh specimens were described and photographed in the field. Small tissue pieces were dried in silica gel and the remaining basidiomes were dried using an oven. Color codes follow Kornerup & Wanscher (1978).

Microscopical observations were made in mounts of H_2O, glycerin, 5% aqueous KOH, Congo red solution, and Melzer's reagent, and at least 20 basidiospores were measured for each of the six basidiomes collected. Q = average length/width ratio derived from each basidiospore measured. Line drawings of microstructures were made from the rehydrated specimens.

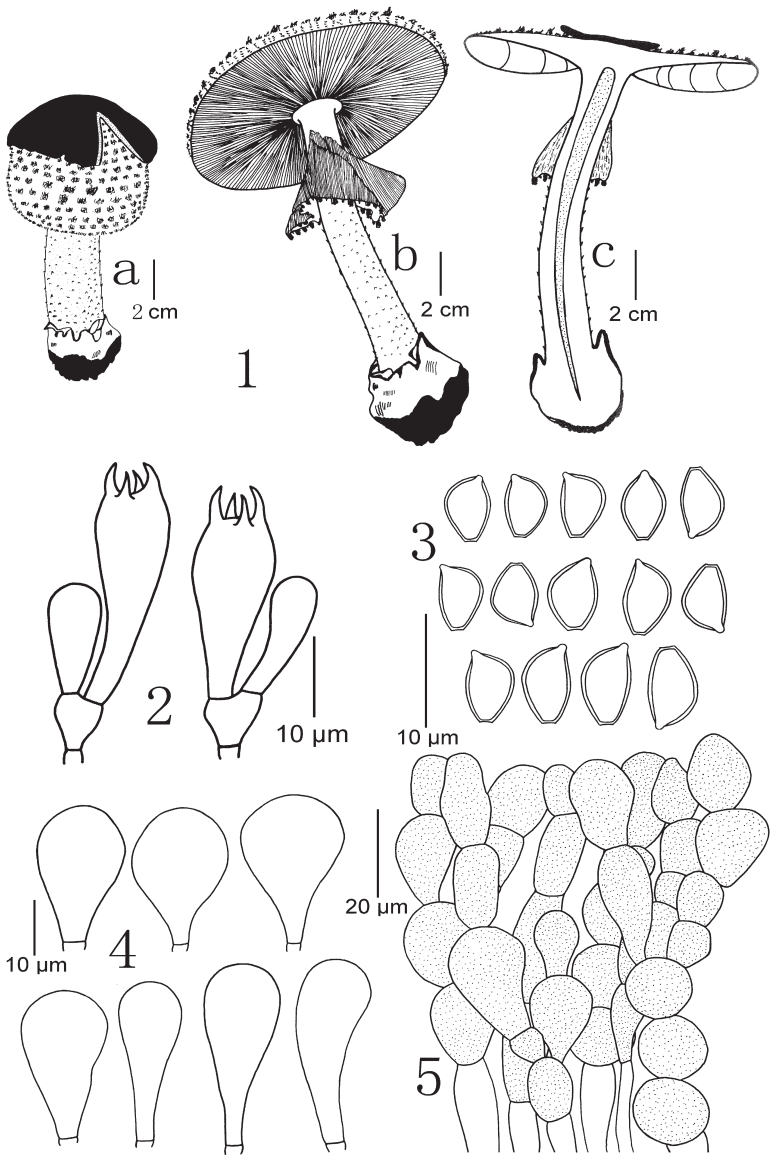
To prepare the basidiospores for scanning electron microscopy (SEM), silica dried basidiome fragments were mounted on aluminum stubs with double-sided tape, coated with gold palladium, and photographed with a Hitachi S–4800 SEM.

Taxonomy

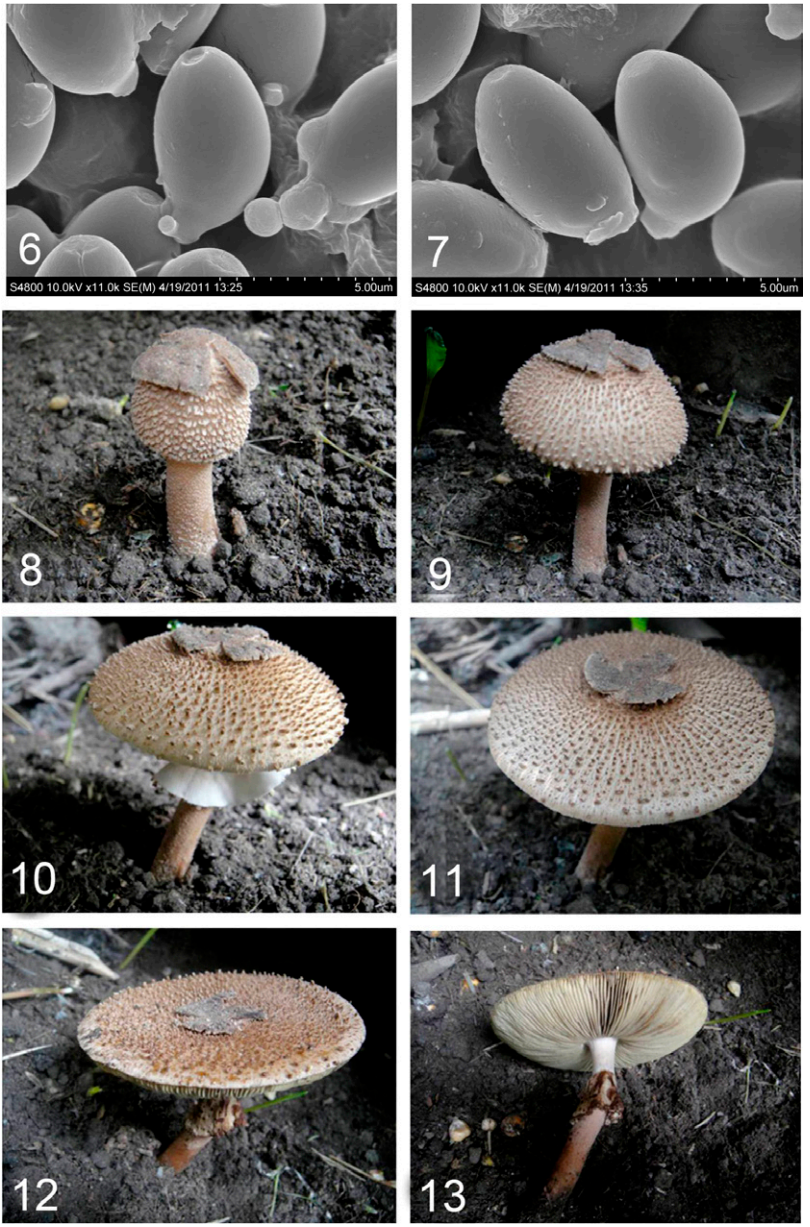
Clarkeinda trachodes (Berk.) Singer, Lilloa 22: 413, 1951. Figs 1-11

Basidiomata medium to large, fleshy. Pileus 80 to 110 mm in diameter, subglobose or hemispherical when young, and becoming convex to applanate at maturity; pellicle brown (6E8) to coffee (6E5-6) or chocolate brown (6E5, 6F5), thin to thick when young and somewhat brown to grayish brown (7E3-5) at maturity; the remaining surface covered with grayish brown (7E3-5) to vinaceous brown (6D8, 8E8) squamules, together with numerous, small, revolute and loosely floccose, brown squamules; context up to 9 mm thick in the center of the pileus, white, instantly turning reddish with exposure. Lamellae 47 × 10 mm, free and remote from stipe, white to dirty white when young, olive brown when mature, becoming red brown after bruising, crowded with lamellulae, margin entire, concolorous. Stipe 80–121 × (28–)31–47(–61) mm, central, subcylindrical, solid but fistulose in aged specimens; surface dirty white to white at the apex, light brown to brown toward the base, glabrous above the annulus, lower half densely covered with minute, brown, furfuraceous squamules. Annulus present on the upper part of the stipe but not the top, up to 18 mm, thick and membranous and remaining up to the maturity, sometimes detached from the stipe when dry, adaxial part glabrous with fine longitudinal striation but abaxial part rough with squamules. Volva present, grayish, dirty white to white, membranous, usually closely appressed to stipe and eventually inconspicuous. Spore deposit not obtained.

Basidia 18–26 × 6–9 µm, mostly clavate to subclavate, thin-walled, tetrasporic (occasionally 2- or 3-spored), bearing four short sterigmata, 1.1–2.3 × 0.8–1.2 µm, hyaline, smooth, lacking incrustations, clamp connection absent. Basidioles narrowly clavate to clavate. Hymenophoral trama interwoven, hyphae cylindrical to slightly inflated, up to 14 µm wide, thin-walled, hyaline, and without clamp connections. Basidiospores (Figs 3, 6–7) (5.0–)5.52–5.96(–6.8) × (3.4–)3.81–3.98(–4.3) µm, mean Q = (1.38–)1.42–1.54(–1.7), ovoid, sometimes broadly ellipsoid to ellipsoid, glabrous, thick-walled (up to 0.6 µm), apiculus



Figs 1–5: *Clarkeinda trachodes*. 1. Basidiome: (a) immature, (b) mature, (c) longitudinal section of mature fruiting body. 2. Basidia with basidioles. 3. Basidiospores. 4. Cheilocystidia. 5. Pileipellis.



Figs 6–13: *Clarkeinda trachodes*. 6–7. Basidiospores showing distinctly truncated and depressed apical germ pore under SEM. 8–13. Developmental stages of a basidiome fruiting in its natural habitat. (Photo: M.I. Hosen).

eccentric, apex or germinating pore prominent and truncate with slightly depressed, olive brown to dark, umber brown in deposit and maintaining the same color after desiccation for 1.5 years at room temperature, dextrinoid in Melzer's solution, not metachromatic in Cresyl blue. Cheilocystidia 24–32 × 10–16 µm, abundant, scattered to more or less crowded, narrowly clavate, clavate to broadly clavate, obpyriform, hyaline, thin-walled, smooth, lacking incrustations, sometimes long pedicel and narrow up to 3.4 µm. Pleurocystidia absent. Pileipellis consisting of short branching chains of 4–7 cells, slightly interwoven, terminal cells 12–22.5 × 8–14 µm, dull brown vacuolar pigment inside the cells in glycerin, water and 5% KOH solutions, thin-walled, clavate, cylindrical, obpyriform to fusiform or spindle-shaped in rare cases, occasionally branching with lateral cells that are mostly clavate, basal cells nearly subglobose to clavate or cylindrical.

Habit, habitat, distribution— The fleshy basidiomes of *C. trachodes* fruit as isolated individuals or in groups of two in disturbed habitats and at forest edges. Our collections were found along the roadside near a *Shorea robusta* (*Dipterocarpaceae*) forest in Bhawal National Park, Gazipur, and on bare soil near a bamboo fence around a village residence in Akhanagar, Thakurgaon, Bangladesh. Known also from China, India, Indonesia, Malaysia, and Sri Lanka.

Specimens examined — **BANGLADESH. Dhaka Division**: Gazipur, Bhawal National Park, 20 m a.s.l., 30 September 2009, M. I. Hosen 617, 619 (HKAS 62856, 62857); **Rangpur Division**: Thakurgaon, Akhanagar, 67 m a.s.l., 16 June 2010, M. I. Hosen 85–88 (HKAS 62852–62855).

Additional material examined — ***Agaricus* sp.**: **ITALY**, South Italy, on sandy ground next to *Castanea sativa*, 1100 m a.s.l., 13 October 1994, Carmine Lavorato (HKAS 49489, as *Clarkeinda trachodes*).

Comments — *Clarkeinda trachodes* is distinguished by a large basidiome size, prominent chocolate or coffee brown to deep brown pellicle on the pileus disc surface, presence of an annulus, olive brown to umber brown spore deposit, slightly thick-walled spores with a truncated apex, and a context that changes from white to reddish brown when cut. Since Berkeley (1847) first described the species from Sri Lanka, it has been reported from south and southeast Asia by Petch & Bisby (1950, as *Chitoniella*), Leelavathy et al. (1981), and Pegler (1985, 1986). Yang (1991) has also reported it from the tropical region of Yunnan, China.

Examination of the specimen from Italy reported as *C. trachodes* by Lavorato & Contu (2002) shows the European record is based on a misidentified *Agaricus* specimen. The Italian specimen bears larger, ellipsoid basidiospores (7–8.5 × 4.5–5.5 µm) that lack a germ pore and truncated apex, and pileal squamules that represent a cutis of filamentous cylindrical hyphae 4–8 (–15) µm in diameter.

Vellinga et al. (2011) and our own sequence analyses (Ge unpub.) nest *Clarkeinda* phylogenetically in the *Agaricus* s.l. clade close to *Agaricus* and *Heinemannomyces* (genera within tribe *Agariceae*).

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Literature cited

Berkeley MJ. 1847. Decades of fungi XV–XIX. Ceylon fungi. London Journal of Botany 6: 479-514.

Kornerup A, Wanscher JH. 1978. Methuen handbook of color. London. Eyre Methuen, UK.

Lavorato C, Contu M. 2002. *Clarkeinda trachodes,* una specie nuova per la micoflora italiana rinvenuta in Calabria. Boll. Gruppo Micol. G. Bresadola 45 (1): 33–39.

Leelavathy KK, Zachariah S, Sankaran KV. 1981. *Clarkeinda trachodes*- an agaric new to India. Mycologia 73: 204–207.

Pegler DN. 1985. The genus *Clarkeinda* (*Basidiomycotina*: *Agaricaceae*). Botanical Journal of the Linnean Society 91:245–252. doi: 10.1111/j.1095-8339.1985.tb01148.x

Pegler DN. 1986. Agaric flora of Sri Lanka. Kew Bulletin Add Ser 12. HMSO, London.

Petch T, Bisby GR. 1950. The fungi of Ceylon. Peradeniya Manual 6. 111p.

Vellinga EC, Sysouphanthong P, Hyde KD. 2011. The family *Agaricaceae*: phylogenies and two new white-spored genera. Mycologia 103(3): 494–-509. doi:10.3852/10–204

Yang ZL. 1991. *Clarkeinda trachodes*, an agaric new to China. Acta Botanica Yunnanica 13(3): 279–282.